LOWELL PUBLIC SCHOOLS

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Response to Motion: K-12 Environmental Sciences Curriculum

TO: Dr. Joel Boyd, Superintendent of Schools

FROM: Robin Desmond, Chief Academic Officer

DATE: December 13, 2019

RE: *K-12 Environmental Sciences Curriculum*

The following report is in response to the motion by Jacqueline Doherty:

> *Request the Superintendent provide the Committee with a report that highlights the LPS K-12 environmental sciences curriculum including any programs/grants offered through Project Learn or other outside entities, as well as school-based initiatives such as student recycling groups, etc.*

Environmental Science Curriculum at Grades K-8
Environmental Science is covered through both the Earth's Systems and the Earth and Human Activity strands in the 2016 STE Framework. These learning progressions start at kindergarten and increase in complexity as they progress through the grade levels.

In kindergarten, students learn to observe and describe weather patterns, and also learn that plants and animals can change the environment. They explore how "reduce, reuse, recycle" can reduce the amount of natural resources an individual uses. Environmental Science standards skip over first grade and are picked up again in second grade. Second graders learn where water is found in our environment and map bodies of water and different types of landforms. They explore how water and wind can cause erosion and design solutions to control it.

Third graders use weather data to predict weather in a given season and learn about climates in regions around the world. They also evaluate design solutions to reduce the impact of a weather-related hazard. Fourth graders learn about weathering and erosion, look for patterns in topographical maps as an introduction to tectonic plates, engineer solutions to reduce the impact of natural disasters, and explore renewable and nonrenewable energy sources. Fifth graders learn about the water cycle, relative amounts of fresh and saltwater on Earth, and how to reduce human impact on Earth's resources by changing an agricultural, industrial, or community practice.

In sixth and seventh grade, students extend their fourth grade knowledge of tectonic plates by exploring evidence that plates have moved great distances, collided, and spread apart. They continue this theme by constructing a claim from evidence about how Earth's surface has changed over time. They also continue work from fifth grade on how the sun's energy and the Earth's gravity drive the water cycle. They learn how data from past geological events can help predict earthquakes, volcanic eruptions, floods, and landslides. They also explore ways to mitigate the negative impact of increases in human population on

the environment. Students learn how convection currents drive the rock cycle, interpret weather data to identify patterns in air mass interactions, and the relationship of those patterns to weather. They examine and interpret data to describe the role that human activities have played in causing a rise in global temperatures over the past century. Sixth and seventh graders also analyze and interpret data to explain that Earth's mineral and fossil fuel resources are unevenly distributed as a result of geological processes. Eighth graders study planetary science as part of their Earth and Space Science domain, so are not involved in "Environmental Science".

Environmental Science Curriculum at Lowell High School

Environmental science is covered in the Grade 10 Biology curriculum as required under the 2006 STE Framework. The Biology team is working in their common planning time to transition to the 2016 STE Framework, as well as to incorporate more information about climate change. Although environmental science goes beyond the scope of biology, students will learn about climate change by having it addressed in a course that all students must take. Currently, the constraints to creating an Environmental Science course include both time in the schedule and funds to support the course. If a course could be created at some point in the future, the 2016 STE Framework recommends the following topics; movements on Earth due to convection and gravity, weathering and erosion, interactions between Earth's systems (the hydrosphere, biosphere, geosphere, and atmosphere), how carbon cycles through Earth's systems, and how variations in the flow of energy into and out of Earth's systems can create changes in climate. Many of these topics would be learned by creating models of the systems. Additional standards address relationships among management of natural resources, the sustainability of human populations, and biodiversity. Global climate models would be analyzed to learn how forecasts are made of the current rate of climate change. Students would make claims from evidence showing how the availability of key natural resources and changes due to variations in climate have affected human activity. Finally, students would evaluate competing design solutions for conserving natural resources, taking into account economic, social, and environmental cost-benefit ratios.

Topics in Environmental Science are addressed in a career exploration course and through dual enrollment studies. Lowell High School offers a separate Sustainability Careers Exploration course where students explore a wide range of traditional and renewable energy sources and how these options impact our environment and society. Students are also exposed to the complex and compelling ethical issues raised by global, national and local changes in how we produce and use energy. The Dual Enrollment Environmental Studies course with Middlesex Community College provides ecological/environmental education designed to develop an understanding and awareness of our environment, how the environment can change and the effects of such change. The course explores the role that humans play in causing environmental change and the underlying values and ethical judgments involved in making choices. It includes the study of the structure and function of ecosystems, thermodynamics, and an examination of selected environmental problems.

Environmental Science Opportunities through Project Learn

In addition to curriculum offerings at the high school, in collaboration with Project Learn, there are many experiential learning being developed:

Lowell High School Class Visit -
Nextera Energy Source, Providing Energy Solutions
Seabrook Station

- NextEra Energy Resources is a leading wholesale power generator, operating power plants and offering a diverse fuel mix to utilities, retail electricity providers, power cooperatives, municipal electric providers and large industrial companies. Today, they are the world's largest generator of renewable energy from the wind and the sun. They have invested billions of dollars – with plans to invest even more – in energy infrastructure across North America, including new wind and solar facilities, transmission and natural gas pipelines, offering our customers innovative solutions to meet their energy needs.

Lowell High School Site Visit -
Boott Hydropower, LLC, a subsidiary of Enel Green
Power North America, Inc.

- Hydropower projects that have committed to environmental, cultural and recreational stewardship pursuant to the Low Impact Hydropower Institute's criteria.

Lowell High School Site Visit -
Water Treatment Plant
815 Pawtucketville Boulevard

- The mission of the Lowell Regional Water Utility is to provide a sufficient supply of safe, potable water to the citizens and businesses of the City of Lowell and surrounding communities in order to ensure their health and safety in a cost effective manner, to ensure the highest water quality and purify some 4.7 billion gallons of water to over 135,000 customers while meeting all state and federal water quality compliance obligations.

Lowell High School Site Visit -
WasteWater Treatment Plant
First Boulevard, Lowell, MA

- The Duck Island Clean Water Facility is a 32 million-gallons-per-day activated sludge treatment plant. The facility accepts wastewater from the City of Lowell and the towns of Chelmsford, Dracut, Tewksbury, and Tyngsborough.

Lowell High School Outreach -
National Grid -
40 Sylvan Rd. Waltham, MA

- Internship opportunities, career speakers, financial support

Middle School -
IDEA Camp- Environmental Programs - Got Dirt (week long summer workshop in July)

- Introduction to urban, rural and sustainable farming
- Organic and GMO food options
- Irrigation and Natural Pest Control

I would like to thank Elaine Santelmann, Coordinator of Science and Social Studies, for the information contained within this report.